

**WHAT IS CLAIMED IS:**

1. A phase-locked battery charge system having a phase comparator, a current pump, a battery, and a differential amplifier, and a voltage control oscillator; wherein its battery charge method comprising the steps of:
  - 5 (a) detecting a battery voltage for said differential amplifier, and releasing the detected battery voltage after amplifying the detected battery voltage, and determining an appropriate voltage for the input of said voltage control oscillator;
  - (b) oscillating a feedback frequency corresponding to the detected voltage by said voltage control oscillator, and feeding the frequency back to said phase
  - 10 comparator;
  - (c) comparing the input frequency and the feedback frequency by said phase comparator and generating a phase error;
  - (d) sending said phase error to said current pump to generate an appropriate charge current to charge the battery; thereby after going through a plurality of
  - 15 aforementioned cycles, the battery being charged fully to provide a steady battery charge, and automatically and successively work in said frequency tracking state, phase tracking state, and phase-locked state.
2. The phase-locked battery charge system of claim 1, wherein said current pump involves in a process comprising the steps of:
  - 20 (a) sending a phase error pulse to a filter to generate a direct current voltage;
  - (b) said direct current voltage being directly proportional to said phase error and said phase error voltage.
  - (c) converting said phase error voltage into phase error current by said voltage/current converter;
  - 25 (d) amplifying said phase error current to battery charge current by said current amplifier; thereby said battery charge current being sent to said battery to implement the battery charge process.
3. A phase-locked battery charge system, comprising:
  - 30 a phase comparator; connected to an input terminal of a low pass filter and an output terminal of a voltage control oscillator, for comparing the input

phase/frequency and output phase/frequency to obtain the phase/frequency error;  
a low pass filter, comprising a current pump, a differential amplifier, and a battery  
and acting as a way for the phase/frequency driver of said voltage control  
oscillator to minimize the phase/frequency error to zero, such that the frequency  
5 of the voltage control oscillator approaching a reference frequency; and  
a voltage control oscillator, connected to the output terminal of the differential  
amplifier of said low pass filter, such that the detected battery voltage being sent  
to differential amplifier for amplification and determining an appropriate voltage  
for the input of the voltage control oscillator; thereby the feedback frequency of  
10 the corresponding detected voltage being oscillated by said voltage control  
oscillator, and fed back to the phase comparator, and then said phase comparator  
comparing said input frequency and feedback frequency and generating a phase  
error, and finally sending said phase error to said current pump to generate an  
appropriate charging current to charge the battery, and the battery being charged  
15 fully after a number of aforementioned cycles in order to shorten the charging  
time and attain a quick full charge state.

4. The phase-locked battery charge system of claim 3, wherein said current pump  
comprises a operation amplifier, a power field effect transistor, a capacitor, and  
two resistors.
- 20 5. The phase-locked battery charge system of claim 4, wherein said resistor and  
capacitor constitutes a filter to provide the voltage for the current pump.
6. The phase-locked battery charge system of claim 3, wherein said low pass filter  
provides a upper-bound voltage to drive said voltage control oscillator in order to  
quickly reduce the error between the input frequency and feedback frequency to  
25 provide a bulk current charge in order to shorten the charge time and attain the  
frequency tracking effect.
7. The phase-locked battery charge system of claim 3, wherein said low pass filter  
can output a current determined by said current pump and control the driving  
voltage of the voltage control oscillator to provide variable current charge and  
30 attain the phase-locked float charge effect.
8. The phase-locked battery charge system of claim 3, wherein said phase

comparator is a positive edge-triggered comparator.

9. The phase-locked battery charge system of claim 6, wherein said phase tracking range is equal to the locked-in range, and the capture range is larger than the frequency tracking range.